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INTRODUCTION

Communications Law II

1987

> Karl Marx held that history is shaped by control of the means of production; in our times history is shaped by control of the means of communication.
>
> Arthur Schelsinger,
> in T. White, America in Search of Itself (1982)

> It is arguably more revealing to use communication systems than production techniques as the boundary marks of history.
>
> Anthony Smith,
> Goodbye Gutenberg (1980)

> ET phone home!
>
> Reaching out after watching
> AT&T long distance commercials

1. Nature of Telecommunications

Not so long ago there was little more to telecommunications than POTS: Plain Old Telephone Service. However, the day of the black rotary dial phone is no more. Since World War II there has been an explosion in telecommunications technology in which it has converged with the technology of data processing to revolutionize our lives. The confluence of microchip and telecommunications technology will yet further accelerate the rate of change.

No longer does the word telecommunications suffice. New terms have had to be coined to describe this convergence of computers and telecommunications such as "compunications" and "telematics". New phrases have entered common speech such as the Microelectronics Revolution, the Information Revolution and the Post-Industrial Age. Some of the sense of urgency with which this changing world is viewed may be seen in the following excerpts from contemporary assessments.

> This increasing interconnection between computers and telecommunications — which we will term "telematics" [1] -- opens radically new horizons. Means of communication have certainly not been structuring communities only in our own day. Roads, railways, and electricity are so many stages along the way from the family to local, national, and multinational organization.
>
> Unlike electricity, "telematics" will not transmit an inert current, but will convey information, i.e., power. The telephone line or the television channel are the building blocks for this change. Today, they are combined into polyvalent transmitters and are starting to link computers and data banks. Satellites will soon provide them with a potent tool. Telematics will not only be an additional network but a different one as well, blending pictures, sounds, and memories and transforming the pattern of our culture.
>
> In varying degrees, telematics will affect all of the long- and short-term aspects of the French crisis. It will affect the economic balance, modify power relationships, and increase the stakes of sovereignty.
>
> If the government can perceive and correct in time the imbalances that computerization can aggravate, and the restrictions and constraints it may generate, it may realize the necessary changes within the next ten years without setting off the "inflexibility/explosion" sequence familiar to our country. These stakes are vital, but they are limited as well. Even if these policies meet with reasonable success, their only merit will be to set the stage for the real upheaval of civilization for which the computer revolution may be responsible over the long term.

Nora, Simon and Minc, Alain
The Computerization of Society,
Cambridge: MIT Press, 1981

We have come to the conclusion that telecommunications, taken in the broadest sense, will form the infrastructure of the new industrial society that is now coming into being around the world. No single person can totally understand this new society — it is difficult to comprehend the course of a battle when you are one soldier fighting in the midst of it — but it is not too much to say that its birth is an event equal in importance to the Industrial Revolution of the 19th century. What is happening now in telecommunications will set the terms of life in the 21st century just as surely as what happened in 19th century industrialism set the terms of life for the 20th century. And Canadians of this generation, as we confront the challenge of telecommunications, are preparing the framework for the national life of Canada in the 21st century — just as Canadians of the 1870s and 1880s determined the shape of 20th century Canada by building our national railroad.

In approaching telecommunications we should realize that its importance demands we view it in a special way. Telecommunications, as the foundation of the future society, cannot always be left to the vagaries of the market; principles that we might care to assert in other fields, such as totally free competition, may not be applicable in this crucial sphere. We must look at it freshly, without preconceived ideas.

Telecommunications and Canada
(Report of the Clyne Committee),
Ottawa: Supply and Services,
1981, pp.1-2

Fortunes will be lost; fortunes will be made. Many an old institution will go under; many a new one will spring up. Authors will drift back into anonymity; librarians will gain vast new powers and respect; teachers will understand at last what drove the Luddites and some of them will teach themselves how to destroy cable-lines. We will all learn to be TV producers just as we once all learned how to write. Pollsters will do serious battle with parliamentarians and the staunch, free-enterprise newspaper owners who fail to adapt or merge will suddenly learn, as their profits disappear, why artists, musicians and book publishers love and loathe the Canada Council. The great corporate battles and mergers of the decade will be among telephone companies, cable companies, publishers, data processors and advertising agencies. Communications lawyers will become rich as the regulations are constantly rewritten and revised. Like the 16th century, it will be an age of magic and an age of litigation, power struggles and sudden reversals of fortune.

Godfrey and Parkhill, Gutenberg 2: The
New Electronics and Social Change
Toronto, 1979, p.2

Not all the commentators present such rosy pictures (for Communications lawyers at least) of the future. They are uncertain of the shape of Canadian life in the decades to come. However all agree we are in the midst of a profound transition that will touch every aspect of modern life. Old industries and old ways of doing things are falling by the wayside. Consider, as only one example, the demise of the Swiss watchmaking industry.

Clearly this period of transition requires that we come to grips with a powerful technology. In turn, this demands comprehensive approaches to policy in order to grapple effectively with widespread change.

The role of lawyers in this world will be to take a broad knowledge that encompasses economics, technology, and politics and apply to this the techniques of legal analysis and legal reasoning. It is an immense challenge - and an immense opportunity.

2. Nature of the Course

The focus will be on government regulation of the telecommunications industry in Canada. "Communications law" is of wider ambit and raises issues that might easily be considered to belong to the fields of contracts or torts. These private law issues will not be dealt with directly in this course although students may choose, if they wish, to write papers in the area.

There will be weekly seminar meetings at which the reading materials compiled for the course will be discussed. Each student, in addition to attending and participating at the seminars, will be expected to undertake a research project. It is possible that this could be a joint undertaking.

3. Substantial Research Paper

As a major paper course, a research paper of 25-40 typed pages is required. A list of possible topics will be provided. This list is not meant to be exhaustive but should help students get started on a manageable topic reasonably early.

The paper is due on May 13, 1987, the last day of the examinations.

It must be carefully typed, fully documented and footnoted and be reasonably free of typographical errors as well as those of syntax, grammar and spelling.

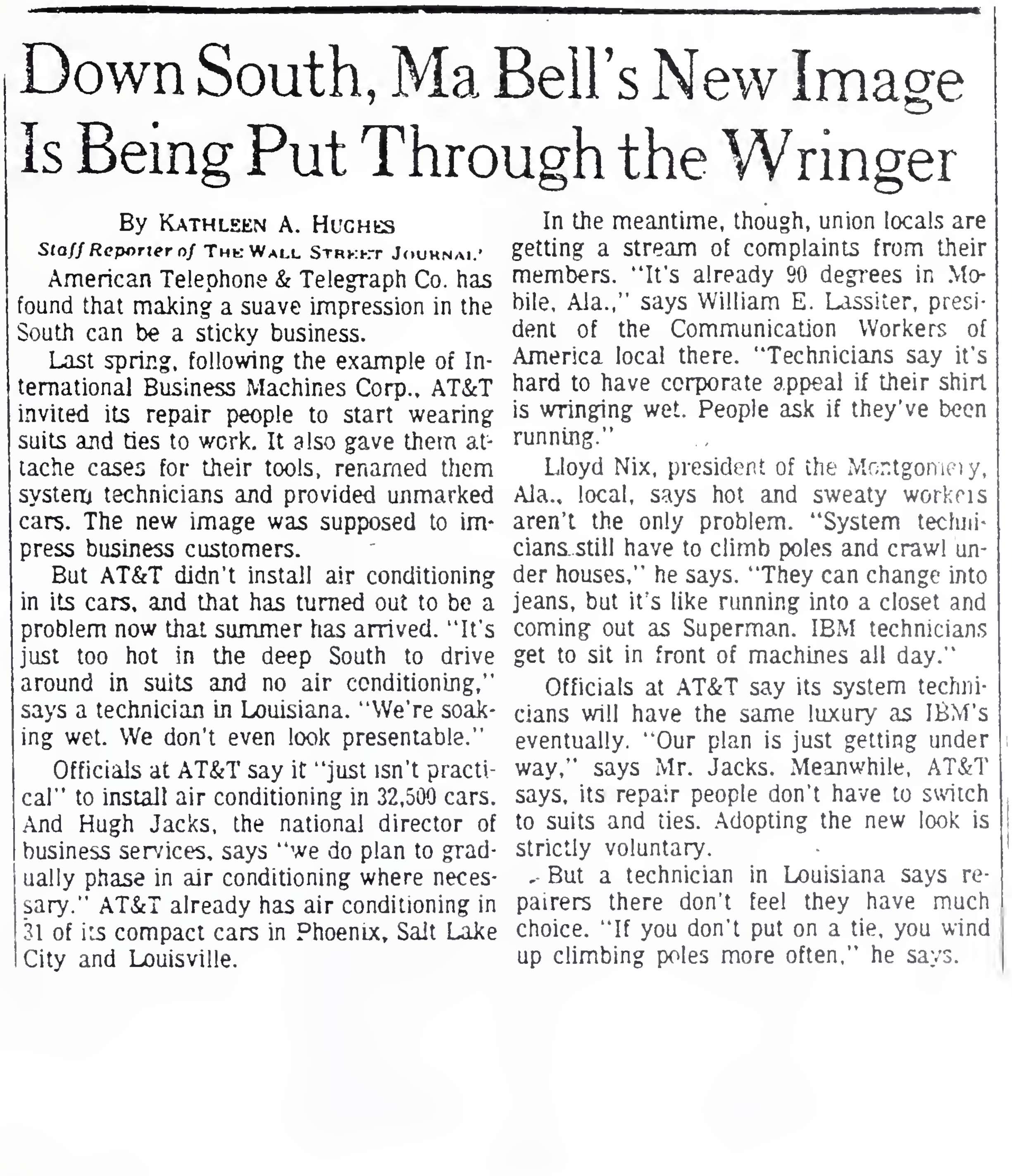
Width of Approach

Students will be expected to acquire a [illegible] specifically legal materials. These include both federal and provincial statutes, regulations, the rules of procedure of both federal and provincial regulatory agencies and some of the cases where telecommunications regulatory matters have reached the courts.

As well, students must be prepared to enter the less structured and familiar world of policy. This will be most obvious with respect to the formal policies developed by the Commission dealing with matters such as terminal attachment and quality of service. But beyond this lies much of regulation and the challenge for the lawyer is to be flexible and perceptive enough to operate effectively in this uncharted territory.

On the ever shifting frontier of law and policy the lawyer needs both imagination and an expansive view of the range of sources appropriate for the effective representation of clients. Early indications of developing policy (or lack thereof) are to be found in trade journals, ministerial speeches, newspapers and magazines as well as the confidences of government and industry officials.

Consider the following small newspaper item.



Wall Street Journal, 29 June 1982

Down South, Ma Bell's New Image Is Being Put Through the Wringer

By Kathleen A. Hughes
Staff Reporter of The Wall Street Journal

American Telephone & Telegraph Co. has found that making a suave impression in the South can be a sticky business.

Last spring, following the example of International Business Machines Corp., AT&T invited its repair people to start wearing suits and ties to work. It also gave them attache cases for their tools, renamed them system technicians and provided unmarked cars. The new image was supposed to impress business customers.

But AT&T didn't install air conditioning in its cars, and that has turned out to be a problem now that summer has arrived. "It's just too hot in the deep South to drive around in suits and no air conditioning," says a technician in Louisiana. "We're soaking wet. We don't even look presentable."

Officials at AT&T say it "just isn't practical" to install air conditioning in 32,500 cars. And Hugh Jacks, the national director of business services, says "we do plan to gradually phase in air conditioning where necessary." AT&T already has air conditioning in 31 of its compact cars in Phoenix, Salt Lake City and Louisville.

In the meantime, though, union locals are getting a stream of complaints from their members. "It's already 90 degrees in Mobile, Ala.," says William E. Lassiter, president of the Communication Workers of America local there. "Technicians say it's hard to have corporate appeal if their shirt is wringing wet. People ask if they've been running."

Lloyd Nix, president of the Montgomery, Ala., local, says hot and sweaty workers aren't the only problem. "System technicians still have to climb poles and crawl under houses," he says. "They can change into jeans, but it's like running into a closet and coming out as Superman. IBM technicians get to sit in front of machines all day."

Officials at AT&T say its system technicians will have the same luxury as IBM's eventually. "Our plan is just getting under way," says Mr. Jacks. Meanwhile, AT&T says, its repair people don't have to switch to suits and ties. Adopting the new look is strictly voluntary.

But a technician in Louisiana says repairers there don't feel they have much choice. "If you don't put on a tie, you wind up climbing poles more often," he says.

The surface humour cannot hide the signs of dramatic developments in the American telecommunications and data processing industries. Why is the world's largest corporation concerned about its image? And why such sudden concern? Why is AT&T attempting to compete with IBM? Does the fact that the image was designed to impress business people tell you anything about the sector of the market in which AT&T is gearing up to compete? But will the competition be in the field of telecommunications, or in data processing, or will it be in some possibly as yet undiscovered hybrid? What is the significance of the fact that soon AT&T's "system technicians" will have the same appearance as IBM's? Who will climb the poles and crawl under the houses? And finally, is the success that greeted this initial foray into the competitive world an indication of things to come. What does this tell you about the frame of mind that exists at AT&T?

Globe & Mail, October 25, 1982

B.C. Tel

W. K. McCourt

Mr. J. C. Carlile, President and Chief Operating Officer of British Columbia Telephone Company is pleased to announce that the Board of Directors has elected Mr. William K. McCourt as Vice-President — Network Marketing, effective October 1, 1982.

In his new position, Mr. McCourt is responsible for the overall coordination and direction of the Company's marketing activities and development of corporate long range plans for new network business opportunities.

Mr. McCourt brings to B.C. Tel extensive knowledge and expertise in the fields of research, merchandising, and operations. Previously, he was employed with Eaton's serving in various executive and managerial positions in Winnipeg, Vancouver, and Toronto. His most recent position was Senior Vice-President of Merchandising.

Born in Vancouver, British Columbia, Mr. McCourt holds a Bachelor of Commerce degree from the University of British Columbia and a Master of Business Administration degree through a combined program at the University of Maryland and George Washington University.

Much can be seen of the dramatic changes going on in the telecommunications industry from this announcement.

For a company which has always seen itself as providing tariffed services, the whole notion of "marketing" is novel, let alone a Vice-President Network Marketing. And then note where he came from - merchandising at Eatons! At least AT&T hired away people from IBM. Sic transit gloria mundi

Few newspaper items will give a clear and definitive indication of a policy shift. But they do have great cumulative value as straws in the wind and act as a vital early warning system of regulatory, industrial and technological change.

5. How to Find what you Need; A Bibliography of Sources

The paper topics will permit students to explore emerging issues in the field of telecommunications law and policy. This emphasis on current developments implies that students are not expected to write a legal memorandum to a putative senior partner on a narrowly defined legal issue. Perhaps the best guide to the expectations of the papers can be found in a cursory examination of the sources selected for the course's reading materials. In addition to articles by lawyers there are items by business people, technicians, economists and politicians. The lawyer's contribution must be to apply his ability to recognize legal issues and his knowledge of the law to this broad and changing field.

Hence the papers are expected to analyze legal issues, but in a broader policy context. The challenge for students will be to merge the "communications" and the "law" aspects into a Communications law paper.

Given the different sort of papers that are expected, it is not surprising that a very different sort of research is required from first year legal writing assignments. Some of the sources of information that students may wish to explore are outlined below. It is suggested that students begin their research investigating those items mentioned under "Additional Sources". Having achieved the necessary broader understanding of their topic, they should then return to the Law Library and the Railway Act.

A final word of caution is in order. The paper topics will emphasize current developments. As the Sunday supplements, the government reports, and the futurists never tire of stating, communications is an exploding field. At times the only constant appears to be the accelerating pace of change. However, students are cautioned against being completely seduced by "futurism". Beneath both the more and the less pleasing future scenarios are stolid legal issues where the touchstone must be the Railway Act and the National Transportation Act. And however imminent the technological revolution may be, it remains only imminent. For most of the past seventy years, both the regulators and the regulated have been responding to a constant set of signals. It is not to be expected that their influence on the future development of the industry will disappear over night.

A. Traditional Legal Sources

1) Decisions of Regulatory Agencies

The decisions of the Canadian Radio-television and Telecommunications Commission are available, if not easily accessible, in the Law Library. Decisions may be found in the Canada Gazette I, or in pamphlet or loose leaf form in the stacks. Earlier decisions may be found in annual bound volumes. A reference in other materials to e.g. 3 C.R.T. 241 indicates the page number in the annual bound volumes of CRTC decisions or policy statements where the decision may be found. While not all of these bound volumes are available in the library, all CRTC decisions on telecommunications matters are available in the stacks in one form or another.

Further, the Canadian Regulatory Report (C.R.R.), a loose leaf reporting service, provides a summary of the most recent decisions of the CRTC, and the more important decisions of the provincial regulatory bodies.

The CRTC also publishes monthly the "Pink Peril", the Telecommunications Bulletin. This publication provides a summary of all public notices, decisions and orders of the CRTC issued during that month. To add your name to the free mailing list, write to:

Secretary General
Canadian Radio-television and Telecommunications
Commission
Ottawa, Ontario
K1A 0N2

The decisions of the American counterpart to the CRTC, the Federal Communications Commissions are reported in the FCC Reports (FCC 2d). These can be found on the second floor of the library.

There is no system of indexing of the CRTC decisions. However Professor Janisch has compiled a personal subject index of CRTC decisions, updated to 1978. Consult, as well, "How to Find Regulatory and Judicial Decisions in the Communications Field" in, Grant, Peter S., Communications and Public Policy in Canada (Preliminary Edition), Toronto, 1979.

2) Court Decisions

Although telecommunications matters are normally dealt with by the CRTC or its provincial counterparts, students should not ignore the emerging body of case law. An appeal to the courts has joined the arsenal of weapons available to dissatisfied participants in the regulatory process, and several major issues have recently been resolved, not before the individual tribunals but in Courts of Appeal. These judgments can be located through the normal techniques of legal research.

Decisions in cabinet appeals are normally dealt with through Orders in Council, not all of which can be found in the Canada Gazette. Locating a particular Order in Council may demand an imaginative approach e.g. contacting the Constituency Assistant of your local Member of Parliament.

3) Secondary Sources

Students should not hesitate to consult the Index to Legal Periodicals, Index to Canadian Legal Periodical Literature, Index to Periodical Articles Related to Law, or the Legal Resources Index (available on Microfilm in the Library).

Note three journals that deal specifically with Communications: the Federal Communications Law Journal (American), Canadian Communications Law Review (available only to 1974), and Comm/ent (a journal of communications and entertainment law).

Further, the University of Ottawa Law Review has recently inaugerated an annual survey of Communications Law. The first survey, being written by Gregory Kane is scheduled to be published in the fall.of 1982.

B. Additional Sources

1) Briefs and Submissions to Regulatory Agencies

These can represent an invaluable source, both for a more precise definition of the legal and policy issues involved and for a statement of the positions of the participants. Students can often obtain these by contacting the offices of the initiating party or by attending at the hearing itself. While the CRTC does have regional offices in Halifax, Montreal, Winnipeg and Vancouver, there is no office in Toronto.

2) Newspapers and Magazines

Students should examine closely the Globe and Mail, the Financial Post, the Wall Street Journal, Macleans etc. Newspapers and magazines chronicle recent developments and industry trends particuarly well. However, as the remarks accompanying the above article about AT&T indicate, it is necessary to read the articles carefully and in context to fully appreciate the implications of the event reported.

In addition to these publications produced for the general public, valuable information can be found in trade journals such as Telephony. In Search, a quarterly publication of the Department of Communications, contains articles on telecommunications matters. While the Law Library should be receiving copies by now, students can be put on the mailing list by writing to:

Information Services
Department of Communications
300 Slater Street
Ottawa

Professor Janisch has a very extensive set of newspaper clippings on all telecommunications matters. These files go back ten years and constitute a potentially valuable source for any paper in Communications Law. An examination of the published reports in a particular topic over a number of years is perhaps the best way to follow industry trends or to observe the emergence of policy.

3) Government Publications

The most obvious Government publications are the reports of the Royal Commissions and task forces that have been appointed over the past fifty years. A list of the relevant reports is set out below:

Canada: Report of the Special Committee of the Senate on Mass Media (Davey Report). 3 vols. Ottawa: Information Canada, 1970.

Canada: Department of Communications. Instant World: A Report on Telecommunications in Canada. Ottawa: Information Canada, 1971.

Quebec: Ministère des Communications. Pour une politique des communications. Quebec: Editeur Officiel du Quebec, 1971.

Canada: Department of Communications. Branching Out: Report of the Canadian Computer/Communications Task Force. 2 vols. Ottawa: Information Canada, 1972.

Canada: Minister of Communications. Proposals for a Communications Policy for Canada: a Position Paper of the Government of Canada (Green Paper). Ottawa: Information Canada, 1973.

Canada: Minister of Communications. Computer/Communications Policy: A Position Statement by the Government of Canada. (Dark Green Paper) Ottawa: Information Canada, 1973.

Canada: Minister of Communications. Communications: Some Federal Proposals, (Grey Paper). Ottawa: Information Canada, 1975.

Canada: Minister of Communications. Statement on Proposed Constitutional Amendments with Respect to Cable Distribution Systems. Ottawa: Department of Communications, February 13/ 1979.

Telecommunications and Canada, Consultative Committee on the Implications of Telecommunications for Canadian Sovereignty (Clyne Committee), Ottawa, 1979

Alberta: Public Utilities Board, Report of the Telecommunications Inquiry into the Provision of Local Non-Broadcasting Services, Edmonton, 1980.

Canada: Report of the Royal Commission on Newspapers. (Kent Report). Ottawa: Canadian Government Publications Centre, Supply and Services Canada, 1981.

Also recommended is a report by two senior French civil servants to the President of France, published in English through MIT Press. The report was a "best-seller" in France after its appearance in 1978. Simon Nora and Alain Minc, The Computerization of Society (A Report to the President of French), Cambridge, 1981.

The Department of Communications and the CRTC regularly fund studies on diverse issues. An extensive collection of DOC and CRTC sponsored reports can be found in Robarts Library. The library of the Department of Communications (see below) also contains many of the studies.

The Annual Reports of both the DOC and the CRTC, available in the Law Library, are helpful in two respects. They contain a synopsis of the organizations' activities over the past year. Further, a list of publications available through that body is usually included. This provides an initial list of materials students may wish to look at.

4) Corporate Annual Reports

More than the balance sheet (which itself may be worthwhile) is contained in the Annual Reports. The companies' reaction to recent developments and planned future areas of activity provide an indication of industry trends. Students should consider examing the Annual Reports of such organizations as Bell Telephone, B.C. Tel., N.B. Tel., CNCP Telecommunications, Mitel, Northern Telecom, etc.

5) Special Interest Groups' Publications

Many of the industry groups regularly make policy statements or submissions to regulatory agencies. These include the Canadian Association of Data Processing Service Organizations, Canadian Business Equipment Manufacturers Association, Canadian Industrial Communications Assembly, Canadian Manufacturers Association, etc.

6) Industry Spokespersons

Students are encouraged to interview spokespersons of any of the above groups. In the past they have proved more than willing to discuss the issues with knowledgeable students.

At the risk of stating the obvious, a word of caution is in order. The industry spokespersons will not write your paper for you! It is suggested that students only contact representatives after they have done their initial research and have specific policy or legal questions they wish answered.

7) Bell Telephone General Rules and Regulations

These govern the terms and conditions under which telephone equipment and service is provided. They are published in the front of your telephone book.

C. Specialized Bibliographies

Grant, Peter S., *Communications and Public Policy in Canada* (Preliminary Draft), Toronto, 1979

Graham, Bruce and Janisch, Hudson, *Select Bibliography: Texts and Other Publications on Telecommunications*. 1976.

Communication booknotes, Centre for Telecommunications Studies, George Washington University

Acquisitions, Library of the Department of Communications, Ottawa

The last monthly publication of the DOC lists all recent acquisitions by their library. As such it represents an excellent list of new material. Copies of *Acquisitions* are available in the DOC branch library in Toronto. (see bel

D. Libraries

Students should be prepared to go beyond the Law library to the Metro Library and Robarts. As well, students are entitled to make use of the books in the Department of Communications at 55 St. Clair Avenue East. Phone 966-6276 to request permission to use the library at the desired time. 473-2780

PREFACE

The purpose of this collection of readings is to provide a thorough introduction to representative contemporary issues in the regulation of telecommunications in Canada.

The materials fall into three broad sections. The first, Weeks I through VI, constitutes the necessary background to any study of telecommunications in Canada. Weeks I and II present overviews, first of the telecommunications industry and second of the commissions and government departments that regulate this industry. The next week canvases the different rationales put forward to justify government intervention, then introduces the most traditional of the traditional regulatory issues: Rate of Return regulation. This is followed by a survey of the differing approaches to the pricing of telecommunications services: why is the basic rate for telephone service in Toronto $12.75 and what relationship does this bear to the costs of providing it? The fifth week presents a brief description of the technology of telecommunications. The section concludes in Week VI with an analysis of the practices and procedures of the Canadian Radio-Television and Telecommunications Commission.

While the emphasis in the first section is on laying a general background for more particular study, some current issues are presented as they arise. The second section moves on to more specific and contemporary issues - the attachment of subscriber-provided terminal equipment, interconnection of the telecommunications network of CNCP with the local distribution facilities of Bell Canada, satellites and the cost inquiry.

The final three weeks are designed for review purposes. A consideration of both the process leading up to the AT&T divestiture of the local operating companies and its probable impact provides an excellent background against which to assess the adequacy of current Canadian proposals. The Road Ahead presents some of the issues that could easily form the second section of next year's materials: the Bell Canada reorganization, the constitutional crisis, and the move away from purely economic regulation towards a more detailed consideration of social issues. Finally, technological developments raise the very real possibility of obliterating any remaining "natural monopoly" justification for regulation and threatens to overwhelm traditional regulation.

These materials are somewhat bulky. However, three factors should be kept in mind in evaluating their length. First in a seminar which by its nature is concerned with broad ranging policy issues, more general reading is to be expected than in a more narrowly focused traditional law course. Second, there has recently been a veritable explosion in excellent writing on telecommunications regulation. These include a comprehensive Law Reform Commission of Canada study of the regulator, the Canada Radio-television and Telecommunications Commission, a controversial report by the

Comptroller General of the United States about initiatives required if the move to a competitive market is to be successful and numerous publications about the effects of the technological juggernaut, as well as some particularly good student papers in this course. Third, it is essential in a major paper course that students have a sound grasp of the basics before plunging into their particular paper topics. It is hoped that these materials will act as a helpful jumping off point for more specific research as well as provide a basis for seminar discussions.

Some General Introductory Readings

Before plunging in Week I into the specifics of the Canadian telecommunications industry, it would be well to look more broadly at the emerging "information age".

The piece from the Economist (an excellent source of current developments) well captures the exciting new world of telecommunications now that the dull old monopolies have been largely overthrown. The excerpt from the Science Council indicates just how profound the impact of microelectronic technology is going to be on our society and the urgency with which policy makers should approach this "transformative technology".

"The Born-Again Technology" The Economist Aug. 22, 1981

New technology is offering the world instant two-way communication—of documents and data as well as voice—from virtually anywhere to anywhere. For equipment manufacturers, the commercial aspects are dazzling; even selling telephone systems promises new riches as the industrialised countries belatedly struggle to acquire the easy access that Americans have enjoyed for decades and as the developing world strives to give its villages their first telephone.

How can governments help their national telecommunications industries to capture the new markets? The American way—dismantling monopoly to stimulate competition—has both excited and bewildered onlookers. The benefits of opening telecommunications to competition, as Mrs Thatcher's government well knows, look enormous. So do the risks. Brenda Maddox reports.

Once upon a time the world of telecommunications was cosy and boring. Few national leaders paid much attention to it and no political hostess felt her dining table adorned by the presence of a minister for posts and telephones. In most countries the telecommunications network was a state-owned monopoly or, in the United States, as near as made no difference. Quietly, between themselves, the national monopoly and its main suppliers agreed what to design and manufacture at what price. Telephone subscribers took what they were given, and manufacturers looked towards their country's traditional export markets.

All that is changed utterly. Telecommunications has moved to the top of the political agenda. New technology is breaking up the monopoly control of telecommunications; companies are begging their governments to help them to innovate so as to win new world markets.

In the United States, President Reagan is taking a personal, and predictable, hand in the seven-year struggle by the justice department, and the five-year one by congress, to break the domination of the communications industry by the American Telephone and Telegraph Company (AT&T). Even so, AT&T, the world's biggest company in spite of being confined to the domestic market, has already formed for the first time an AT&T International. In Britain, the telecommunications business has been split off from the labour-intensive postal service and itself opened to competition. The bill making all this happen has been called (by Mr Kenneth Baker, the industry minister responsible) the single most important piece of legislation to be passed by this government.

In Brussels, the European commission is labouring to persuade the EEC member countries to relax their protectionist barriers and sell telecommunications equipment to each other. In Geneva, the United Nations International Telecommunications Union has declared 1983 Telecommunications Year, with a goal that will please manufacturers: to bring every country up to a standard of one telephone for every hundred people.

Telecommunications owes its enhanced political status to three separate forces:

- Governments like the British and French which have realised that their countries cannot participate in the full flowering of information technology without good telecommunications.
- The computer and telecommunications industries, each of which sees its main possibility of future growth lying in the other's traditional territory.
- Multinational companies and banks which have woken up to their need for a round-the-clock, unimpeded global flow of information and cash transfers—and to the fragility of their communications links. The big spenders (which account for more than 40% of the revenue of AT&T's Bell telephone system) want more choice and better service.

Add to these the facts that telecommunications' modernisation involves massive expenditures of government money and raises problems of redundancy and protecting domestic industries, and it is obvious that telecommunications is never going to go back to its old quiet corner.

A digital tide

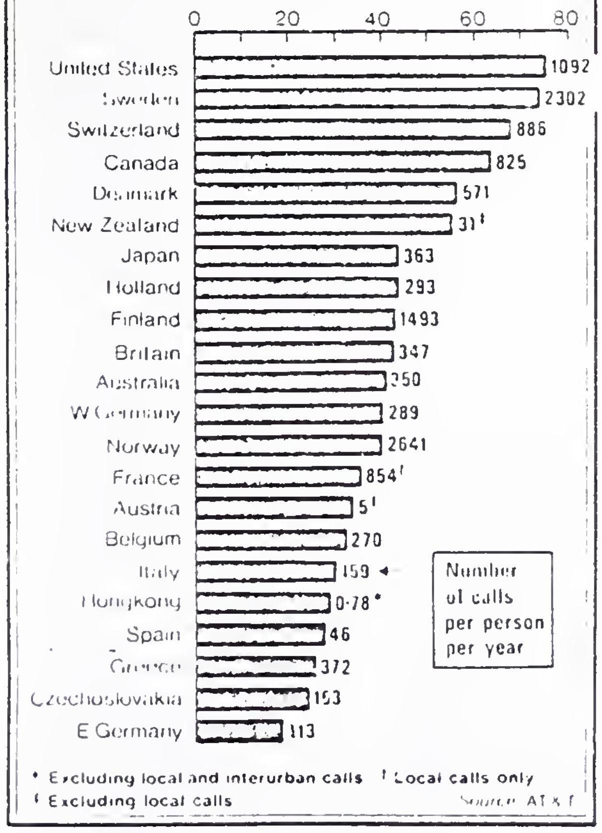
Technology has created all these pressures. Digital techniques and microelectronics have rejuvenated telecommunications, giving its devices the speed, lightness and "intelligence" of computers. The distinction between telecommunications and computers is now technological nonsense. If, indeed, it ever made sense, for it was AT&T's Bell Laboratories which invented the transistor, whose ability to switch electrical current "on" and "off" in a tiny space with no moving parts, made the computer industry possible.

Today the world's telephone networks are changing over to computer language, using on-off (or digital) codes and abandoning the traditional analogue code. In analogue transmission electrical pulses mimic the rise and fall of the human voice and, travelling at 9.6 kilobits a second, woefully slow down data transmission in the telephone network. In digital form, voices, data, telex and facsimile can all travel at 64 kilobits a second, also more cheaply and more accurately.

Telephone exchanges are also going digital. The heart of any telephone system, the exchange is the place where incoming calls are accepted and routed to their destination. Even old-fashioned electro-mechanical exchanges, which click out telephone numbers step-by-step, are now often controlled by a computer. New all-electronic digital exchanges like Britain's costly System X (see later) work without moving parts and are, in effect, computers themselves. It is not surprising that the world's largest computer is owned by a telephone company- Nippon Telegraph and Telephone.

The top telephoners

Number of telephones per 100 population, Jan 1, 1979



* Excluding local and interurban calls † Local calls only
‡ Excluding local calls

Source: AT&T

Nor should it be surprising that computers can act as telephone exchanges. They can set up a path between two telephones, just as they can do addressing or billing or almost any office chore. Certainly they can deliver messages: IBM sees electronic mail the high-speed delivery of printed documents—as the logical extension of its business.

The coming together of these two technologies, one new, the other old, has caused the French to invent the word "telematics", a Harvard professor to come up with "compunications" and the industry to speak of "convergence". What they all are trying to convey is that nobody—not bureaucrats, not lawyers, not customers, certainly not engineers—can say anymore where data-processing stops and message-carrying begins.

Both industries are enjoying a fall in costs and rise in capacity of about 10% a year in real terms, thanks to the benefits from large-scale integration, the packing of more and more transistors on to a single silicon chip.

The rivalry between the two industries presents a big headache for government. (IBM versus AT&T is arguably the biggest political fight in America.) The consolation to all sides is that the converging industries may be fighting over an expanding pie that may prove more than enough for both.

Optical reality

Communications traffic travels four ways, depending on the distance it has to cover: along pairs of copper wires for local services; by microwaves (tower-to-tower) for distances about 30 miles apart; through copper coaxial cables, particularly for long-distance trunk routes over land or sea, and by satellite for very long hauls, particularly over water.

All transmission media are still expanding in capacity and speed: an AT&T subsidiary's coaxial cable being installed in California can, for example, transmit an entire 76-page newspaper from city to city in a second. Satellites are growing bigger and bigger (and earth stations correspondingly smaller and cheaper).

They are considered to be a mature middle-aged technology. The first Intelsat satellite over the Atlantic carried 240 telephone conversations or two television channels. The latest Intelsat V carries 12,000—and television as well. By the end of the century the Intelsat system should be offering 700,000 international voice circuits. Satellites will be launched by shuttle, assembled in space to form clusters or erected on platforms as big as a football field. So what else is new?

Optical fibres, that's what. Five years ago the great hope for the next leap forward in terrestrial transmission lay in waveguides: hollow tubes along which pulses of laser light were to be sent, carrying telephone calls by the thousands. Both AT&T and the British Post Office (now renamed British Telecom) committed themselves wholeheartedly to waveguides. Now waveguides are dead and forgotten, killed by the surging success of the development of optical fibres.

It is now possible for two strands of high-purity glass, each thinner than a human hair, to carry 2,000 telephone calls. Four pairs can be squeezed into a cable (see the cover of this survey), whose size corresponds to that of a coaxial cable as a pencil does to the human arm. As glass is cheaper than copper, and the photons of light which carry the signals inside the fibre are cheaper than the electrical pulses which go along a coaxial cable, optical fibre requires far fewer repeaters.

Optical fibres, according to a study by Mr Malcolm Ross of Arthur D. Little, could become more economic than satellites over all but the longest distances by 1995, even on transoceanic routes. (The first transatlantic fibre optic cable is projected for 1988.)

Optical fibres are going into trunk networks now. Britain already has 4,000 miles in service, which operate at a maximum of 140m bits a second. AT&T has begun to set up a 631-mile optic link between Washington and Cambridge, Massachusetts. Nippon Telegraph and Telephone plans to introduce a commercial test in 12 cities. The French, Germans and Swiss have also begun to install optical fibres. The next step ahead (already under construction by British Telecom) will use an even finer fibre, and will carry 10,000 telephone channels.

The next obstacle looks harder: finding how to use optical fibres for local links with homes and offices. When this technique is perfected, the telephone cable will become broadband (that is, carrying a far wider spread of frequencies than narrow-band telephone wire) and therefore able to carry television into the home. It will then rival satellites and cable television as a medium for distributing pay-TV films. Right now Bell is conducting local optical experiments in Connecticut and New York, while France is embarked on an ambitious optical-wiring of homes in Biarritz.

Is there any demand for so many channels at such speed? The marketplace will tell. But technically, transmission is a problem solved. After glass hairs, there is nothing left to pursue. Except perhaps the electrical transfer of thought? "Who would want that?" asks an engineer. "Thought is awfully slow."

Getting the goods

While debates rage about the best way to improve public telecommunications networks, the consumer goods that attach to the ends of the network are becoming so attractive that some people will buy them even if it means defying the law, as they did in Britain with citizens' band radio.

What you can buy depends on where you live, not on technology. For a start, you might consider a **satellite earth station.** About $6,000 will get you (in the United States) a 10-foot dish that will impress your neighbours and pull down 40 or more television programmes from the sky. If you live somewhere else, or don't have the money, just wait. The dishes will drop in size to a yard across and the price to about $100.

More modest gadgets include **intelligent telephones,** which will soon (even in Britain) become as commonplace as the socket and plug that allows all telephones to be moved from room to room. These can accept instructions to forward calls, wake you up, leave messages, calculate the cost of the call and remember for you the telephone numbers you frequently call.

The age of the **answering machine** is just dawning. The kind to buy is one which allows you to ring home, collect messages that have come in and change the message you leave behind. This device can act as a family message centre, collecting and delivering messages from husband, wife and children without any of them needing to be at home. (You need to send an acoustical signal into the machine to retrieve your messages; other callers will not get them.) The commercial possibilities of these machines have hardly been tapped—as a means of communication on the day's inventory between, say, a supermarket chain and its branches or of taking orders for advertised goods and services. One improvement over older varieties is that these new machines, when delivering a stored message, begin at the beginning.

Cheaper is the **electronic answering service** which can deal with calls for thousands of subscribers, storing their messages in electronic cubbyholes. The subscriber can retrieve messages just by giving his own tone or number.

A **scribophone**, or writing telephone, enables the user to display drawings or graphs on a videoscreen attached to the telephone. By writing on a sensitised electronic pad, the speaker can alter the drawing during the conversation.

Some innovations are demanded by the public; others are thrust upon it.' Time will tell whether the customers want **videotex**, a marriage of the television screen with telephone lines. Britain's Prestel was designed for home users but a number of costly years later it now seems to be finding its future among business users who want it not for retrieving general information but for transactions like exchanging information about reservations and for retrieving information in other systems' computers. Like high-speed **facsimile**, for which there is a greater demand, videotex service will be slowed up by a confusion of technical standards, for such services, before taking off commercially, must be able to interconnect with millions of others.

The **cordless telephone**, on the other hand, is gaining ground in Britain even though it is illegal and has every prospect of remaining so. This is a portable extension telephone—indispensible, once he's tried it, to a farmer, builders' merchant or car dealer who wants to be able to receive calls when away from his single, fixed telephone. British Telecom would be happy to provide these cordless telephones; electronic goods shops do sell them (penalties against them doing so are coming soon) but the home office will not release the necessary radio frequencies.

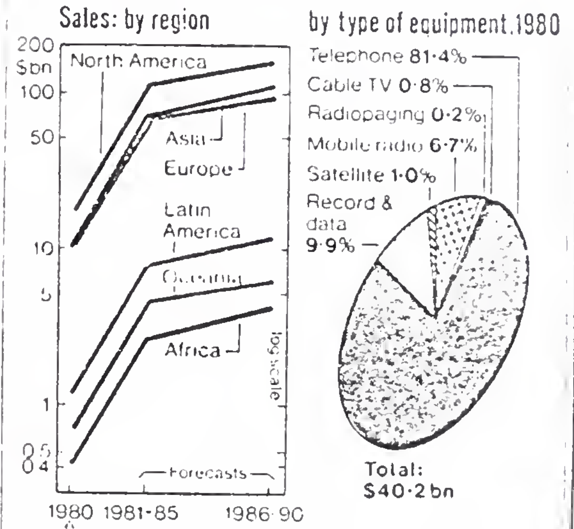
On the move

Over the next decade, the world will spend $640 billion on telecommunications equipment, estimates the consultants, Arthur D. Little. A good share of that will go on mobile radio, including satellite-borne maritime communications, air-to-ground services and an infinite variety of forms of telephoning between cars and public exchanges.

Radio paging—one-way communication between a station and people on the move—is already a winner. Very popular in the United States and Japan, it is underdeveloped in Europe, but British Telecom expects to reach 1.6m people with its new nationwide service in a few years. Among its offerings is a "pager" made by Standard Telephones and Cables which is as small as a cigarette lighter and dispenses four tones, indicating which of four numbers to call back.

The growth of mobile communication will be aided by the increasing sophistication of **cellular radio**. This technique helps overcome the obstacle to mobile communications everywhere—the shortage of radio frequencies over which to travel through the air. Cellular radio uses low-powered base stations to communicate with mobile transmitters (or car telephones) and then links them to the public telephone system. The transmitters are located throughout a city, which is subdivided into a honeycomb of small radio zones. Thus, radio frequencies which would otherwise be occupied by a few services city-wide can be broken up and re-used over and over again in different areas—as long as two adjacent areas do not use the same frequency.

World telecommunications markets



Source: Arthur D Little Inc

Trials of this technique are under way in Britain, continental Europe, Japan and Mexico. The Bell system is conducting a $20m field trial in Chicago. The capacity of that 2,100-square-mile patch is now about 5,000 subscribers but could, as cell sizes become progressively reduced, eventually support 300,000 car telephones—more than any but the biggest cities might require in the foreseeable future.

Cellular radio opens up the possibility of the telephone on every wrist, and the personal telephone number. Some day it will seem absurd to ring a telephone when it is the person, not the instrument, that you are trying to find.

Speak to me

What's the biggest obstacle between man and computer? The need to address it in a special language typed in on a keyboard. So the race is on to smooth the "man-machine interface". The pot of gold will go to the first company to market a machine that understands the unconstrained continuous speech of man, woman or child.

"Voice recognition" is of vital importance to telephone services, to banks and also to two other groups: the Japanese and the male sex. The Japanese because their language is fiendishly difficult to handle in office systems using a keyboard (think what the Japanese might have accomplished in exports without this handicap) and men because, by and large, they have not learned to type. If men want to instruct a word processor (that is a typewriter and a screen connected to a computer) they have to get a secretary to type the instructions in.

It is not irrelevant to the slow advance of sophisticated telecommunications in Europe that so many businessmen are unrepentant male chauvinists. They see most office work as women's work. Even the salesmen of advanced business machines think of their new products as a superior female. "Like a good secretary", one extolled his office automation system, "it will do virtually anything you tell her to do." Or as the managing director said of his electronic switchboard: "It can do filing too—better than some little girl in cotton knickers." The irony is that women executives are resistant to word processors too, for the keyboard reminds them of secretarial work—something they have risen above.

Machine recognition of virtually any number of voices will come in 20 years or so, but it will be preceded by three other steps:

○ **Character recognition.** This technique is well advanced, providing a world market of $400m a year in systems that can read text—typed, printed or handwritten. Banks and postal systems are the big customers while the most visible version is the hand-held reader used in stores to read price labels.

○ **Voice response.** Starting with Texas Instruments' Speak and Spell, a growing range of electronic games vocally tells the player how well he has done and invites him to try again. The technique, spurred by large-scale integrated circuitry, will make rapid headway in both public and private telephone exchanges; in offices, it can truly do the secretary's chores of saying "out to lunch" or "on holiday until the first of the month" and the voices, assembled from the basic elements of speech from a digital store in the computer, are becoming increasingly friendly and humanoid. (It should not be difficult to replace the robotic sound of the Bell-trained operator: "That li-on is busy.")

○ **Voice identification.** Systems can already be designed to recognise the identity of a particular speaker (by matching his voice with the stored record of his voice). Eventually the technique may be used in police work to trace and match voices, like fingerprints. More immediate applications will permit selected access to paying-by-telephone, to bank statements or to security-protected buildings.

On the way to the long-term goal, the voice typewriter should emerge, turning the spoken word into printed text. Gradually, then, voice recognition machines will be able to comprehend an expanding vocabulary and an increasing variety of voices, not just their programmer's. Eventually they may supersede push-button telephones as the instrument of communication. The manager will then be able to shout instructions at the computer instead of at the secretary and the industrial worker can sit and talk to his machine.

First, choose your switchboard

Business, not the home, will lead the drive for new telecommunications products and the essential piece of equipment for any company interested in joining the information revolution is a computer-controlled switchboard. Saddled with an ugly label—PABXs (for private automatic branch exchanges)—electronic versions give companies a chance to create a superb internal telephone network, connecting branches with head office, and offering, in addition, automatic retrying of engaged numbers, call forwarding, conference calls, itemised billing, night answering service and even data-processing. (The 300-line PABX just installed at the Dorchester Hotel by Philips Business Systems, for example, not only handles all telephones but prepares the customers' bills and supplies the hotel's pay-TV service.) Their most conspicuous advantage is to cram the kind of switchboard equipment that used to fill an eight-by-five room into a space the size of a briefcase.

Their eventual applications seem boundless. PABXs can control machinery remotely, they can "manage" energy, in the sense that they can turn electricity on and off in specified locations, carry burglar and fire alarm signals and they can connect word-processors. Simply automating message-taking might make it worth a company's while to invest in a big electronic PABX, for today only one in four telephone calls reaches the intended person at first try and to eliminate the time wasted in waiting and transferring calls would mean a big jump in office productivity.

But only if a company can buy what it wants. Telephone monopolies are very jealous about what may be attached to their networks. IBM found that the PABX marked the front-line between the rival computer and communications industries when in 1968 it tried to introduce its first digital-controlled switchboard in Europe. For a long time it could not get permission from the British Post Office, for example, to install it.

The fact is that, apart from public telephone exchange equipment, PABXs are where the big money now lies and telecommunications monopolies tend to favour their national suppliers, and to control installation and maintenance themselves.

One of the most powerful forces leading to the demolition of British Telecom's monopoly was the rage and frustration of British businesses waiting for 18 months or more for British Telecom (or the old Post Office) to give them a switchboard. Theirs is a diluted victory, however. British Telecom will not have to surrender its monopoly on small PABXs (that is, those with under 100 lines) for three years. In that period, if British businesses want to buy themselves the Canadian Mitel PABX (available abroad for about £90 a line) they will have to take the version British Telecom is manufacturing under licence—at a higher price.

X marks the question

Don't be deceived by the new gadgetry. Public telephone equipment is what accounts for 50% of the world market for telecommunications equipment of all kinds. As Britain has learned to its cost. It was the world leader in exports until 1963, then lost its lead because of a disastrous misjudgment about the kind of exchange to replace the old electro-mechanical system that was the backbone of everybody's prewar telephone network.

Britain is now trying to recapture that lead with a digital exchange called System X. It is not going to succeed. What is clear to anybody outside British Telecom and the consortium of its three big suppliers (Plessey, GEC and STC) which were paid to do the development, System X will make about as much impact on world markets as the Concorde. Not that the exchange won't work. It will, and well. System X simply is too late, and too over-engineered to overtake its rivals.

Every major manufacturer is now scouring the world for new markets, with its own model of digital exchange as its standard-bearer, complete with soft loans from its government and promises of local manufacture as bait. Even Western Electric, AT&T's wholly owned supplier, which already has 80% of the American market (and is likely to hold on to it no matter how the justice department's anti-trust suit against AT&T comes out) is looking for contracts abroad. Japan is best placed to scoop up many of the new markets in Asia (which will constitute a market 20% bigger than Europe's) by 1990. Among the European contenders, Sweden's L.M. Ericsson probably has the lead in digital exchanges; its AXE system has been sold to 27 countries, including Ireland. Belgium-based ITT's System 12 is doing well and CIT-Alcatel and Thomson-CSF of France, both spurred by that country's massive investment programme, have each sold their respective digital exchanges in about 20 countries. The fattest contracts have gone to groups: Philips, Ericsson and Bell Canada captured Saudi Arabia's contract while Thomson and Siemens of Germany are handling the £2 billion modernisation of Egypt's telephones.

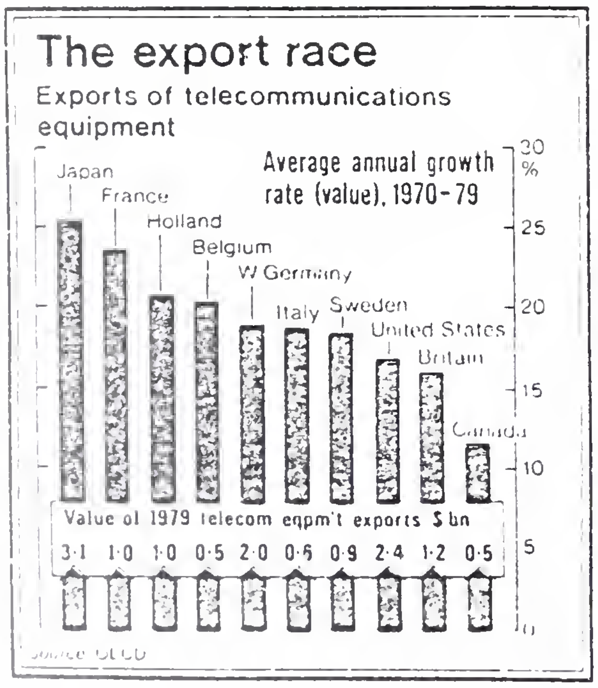
So far System X, unveiled in Geneva two years ago, has not got a single international customer, although there are some nibbles which the suppliers (working through a joint marketing group for exports) call promising. There are high hopes that India will bite. At home Britain already has one System X exchange working, and should have eight in place in the domestic network by the mid-1980s.

Only eight? That is not fast enough to pull Britain into the mainstream of digital telephony. By then System X's benefits, like the long overdue itemised telephone bill, will be available only piecemeal—at extra cost, probably a high one. France will be installing nothing but digital exchanges. The Bell system electronic exchanges already offer some subscribers the kind of enhanced telephone service enjoyed in Britain only by owners of big PABXs.

Mr Michael Corby of the Telecommunications' Users Association advises: "For planning purposes, for the next five to 10 years, unless you are in an exceptional area, you can forget about System X." Until more than half of all subscribers are connected, it will not bring overall improvement to the British network—and not even then unless British Telecom also manages to revitalise its leaky cable networks under the streets.

The worst thing about System X lies in its development cost, although any foreign buyers will be shielded from that. Claiming that System X is the only digital exchange in the world to have been financed virtually entirely by the telephone authority, not the manufacturers, British Telecom will not deny that £400m has been spent and its critics think that £1 billion is nearer the mark.

Its design weakness—which British Telecom has now told the engineers to try to cure in the second generation—is that it incorporates too much "intelligence" in the exchange, making it slow to develop and costlier than necessary. Business customers will already have paid for such information-processing services in their terminal equipment. Where to concentrate intelligence, or computer power, is a general problem in network design. The current philosophy is to diffuse it to the ends of the system—where the customers will pay for it—and to leave the central exchange as simple as possible. System X is too clever by half—at today's telephone subscriber's expense.


The export race

Exports of telecommunications equipment

Source OECD

The sound of breaking monopoly

When the chairman of AT&T, originated in 1877, says, as Mr Charles Brown did last year, "This is Year One in the history of the Bell system", something must have happened. AT&T's competitors knew what it was: the telephone company had been let into information-processing for the first time.

The door was opened by the Federal Communications Commission (FCC) which decided that AT&T could enter the business of equipment-selling and providing information services—as long as it did these through a separate subsidiary. Until now, AT&T has been kept in a patch labelled "communications" by the 1956 consent decree which settled the justice department's previous antitrust trial against it. At that time AT&T agreed not to enter any business not regulated by the FCC. (Nowhere are the artificial barriers between communications and computing more real than in Washington, for the FCC is empowered by congress to regulate communications and approve rates and services. It leaves the computer industry alone.)

AT&T, known with no particular affection as Ma Bell, is now busy setting up its new subsidiary, nicknamed inevitably Baby Bell. By next March, unless congress or the courts intervene, AT&T will have transferred between $10 billion and $15 billion (a mere 10%) of its assets to Baby Bell, which can then sell PABXs, smart telephones and all kinds of electronic information services. To listen to many potential competitors, the game is as good as over. Who, they ask, can compete against a member of the Bell family, no matter how far removed? Somehow the subsidiary is bound to benefit from the parent's computers, transmission systems, laboratories and mind-boggling wealth.

While AT&T never had a European-style monopoly on American telephone service, until 1968 it did have a total grip on supplying equipment (from Western Electric) to its network. Its regional companies supplied about 80% of local telephone services, while more than 1,000 others, including the giant General Telephone and Electronic, accounted for the rest. And AT&T's Long Lines held a genuine monopoly on the national trunk network.

In a swift series of blows about a dozen years ago, the FCC shattered AT&T's monopoly powers. In 1968 it issued the Magna Carta of the information revolution: the Carterfone decision, which allowed a small cordless telephone, not made by Western Electric, to be attached to the Bell network. Then it licensed other communications companies to operate, either on their own lines or on lines leased from AT&T, long-distance telephone services.

By now AT&T is living in a world in which it has four competitors for the national telephone service, who advertise in newspapers how much cheaper their calls are than Bell's and how much nicer it is to get a bill by credit card rather than in a telephone bill. AT&T hesitates at giving such carriers local rides from their trunk system into its local networks even though the FCC, and now congress, want it to interconnect.

There are also a number of domestic satellite networks in the United States which take business that might have gone to AT&T. The only one that really worries AT&T, however, is Satellite Business Systems (SBS), owned jointly by IBM, Comsat and Aetna Life Insurance.

A year ago SBS, using higher frequencies than other satellites, began providing a totally independent national broadband network that vaults over AT&T's telephones entirely. SBS is a satellite-to-rooftop, rooftop-to-satellite system for big companies, offering the instant delivery of documents, video-conferencing and ultra-high-speed data transmission that only an end-to-end digital service can.

With so much competition, it is no wonder that AT&T feels it was only getting some of its own back when the FCC said it could enter into information services. What should be the future limits of AT&T? The battle has been raging in congress, as well as in the antitrust trial. The justice department accuses AT&T of using its power and its prices unlawfully to stifle would-be competitors. It wants AT&T broken up much further. Others argue that AT&T will turn into the sole information-provider for the United States: Big Brother would be preferable. But the defence department is on AT&T's side; national security could be jeopardised, it says, if the Bell system were weakened. AT&T says its challengers are simply trying to break up "the most successful business organisation the world has ever known." And at this moment, it looks as if the Reagan administration, increasingly uncomfortable about the antitrust suit, may agree.

Universal truths

American experience with deregulation is being studied anxiously from Dublin to Canberra. There ought to be universal truths in something as common as telephone service. Is a telephone network a natural monopoly because its chief value is that it connects everybody to everybody else? Or is monopoly obsolete, a structure incapable of delivering new services as fast as business and industry need them and as technically based companies can invent them?

The quandary is a genuine one, for few countries have the geographic scale or the heavily trafficked main routes of the United States. If a country allows competition for its telecommunications monopoly, can that organisation remain financially strong enough to invest in the new digital networks that are essential? And what will competition do to standards? "Deregulation," says Mr Philip Hughes, the chairman of Logica, "is an invitation to massive incompatibility". The emergence of rival brands of video recording, videotex and facsimile systems is not encouraging. Nor is the American experience with telex; unlike Europe, it is stuck with two incompatible telex systems, and that handy service is underused in the United States as a result.

How hard it is to draw lessons from American experience has been shown by reactions to the report of Professor Michael Beesley of the London Business School. Asked by Sir Keith Joseph, the British industry minister, to take a look at the possible liberalisation of the use of the British telecommunications network, Professor Beesley concluded that the benefits to the consumer outweighed the projected loss to British Telecom. He changed nobody's mind, only attracting predictable reactions on pro-monopoly and anti-monopoly lines.

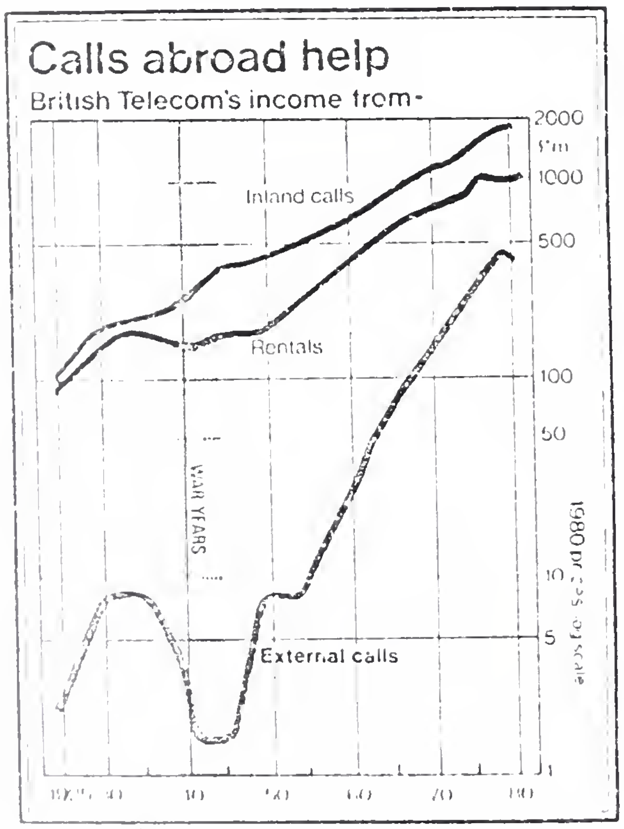
There are, however, a few clear points from the American story that other countries should keep in mind:

- "Liberalisation" of telecommunications comes in three parts: attachment of customer-owned equipment to the telephone network; resale of telephone lines leased from the telephone authority; and a flly independent competitive network.
- The telecommunications' monopoly's favourite argument that outsider equipment will harm the network may be a myth. The FCC has had virtually no complaints about interference since the Carterfone decision.
- Competition has not driven up AT&T's rates. The 1980 revenues of the

four rival trunk telephone companies represent about 2% of Bell's $20 billion, while Bell's long-distance rates over five years have risen far less than the consumer price index.

- Any organisation like AT&T or British Telecom has a lot of hidden power to use against competitors. AT&T has given its competitors poorer quality lines, as their interconnection to local networks, and it has required them to give their customers cumbersome 19-digit telephone numbers in order to interconnect with the Bell system.
- Cross-subsidies in anything as sprawling as AT&T are almost impossible to detect fully.
- The privatisation of telephone service can work—but only if a sophisticated regulatory apparatus, including a whole corps of communications lawyers, is created to supervise it.

The most valuable lesson from America may lie in the experience of SBS, not of AT&T. The new satellite company is finding that 95% of its business is not in its exotic new services or even data transmission but in the plain old telephone service. What the big business user wants most are cheap and flexible alternative national circuits.


Calls abroad help
British Telecom's income from-

There is one respect in which American experience with deregulation is not transportable. There is in Washington a disillusion with government policy-making that extends from big-business conservatives to public-interest liberals. All feel they have seen too many policies turn out to have unintended results and, in communications, too many bureaucrats, with no business experience, assuming that the environment is a static one in which the pieces just need rearranging.

The final results of the American experiment will not emerge for another decade: does competition stimulate more than it damages? But by then other countries will have to have made their decisions.

Don't cry for BT

This is also Year One for British Telecom (BT). Created a year ago out of the telecommunications side of the former Post Office, it has retained far more monopoly power than AT&T has. It has the right to supply the first telephone on any premises. It can raise its rates on its own volition. It can invest in expensive new services like Prestel whether or not the public wants them and without justifying the investment to shareholders, and can refuse to offer services like AT&T's WATS (flat monthly rates for calls between two points, based on number of hours rather than range of calls) for which there is a demand.

British Telecom is policed not by an experienced regulatory agency like the FCC but by the department of industry in which there are now factions so giddy with the excitement of monopoly-breaking that they can hardly see what the monopoly is getting up to while they try their hand at the game. In the year while waiting for the bill to become law and the first of the stages of "liberalisation" to come into effect, British Telecom has inserted itself quietly into many of the fields that prospective competition is aiming for, like satellite business communications and electronic answering services. Anticipating that for the first time it will face competition in telephones, teleprinters and switchboards, it can also sell these things outright itself. It has set up its own Baby Bell already—British Telecom Enterprises.

The Telecommunications Bill itself merely separates posts and telephones into two corporations and permits competition at the discretion of the industry secretary. Almost every important question—how much competition, what kind of standards—is left to this member of the cabinet of the government of the day. While Sir Keith Joseph is a diehard free-enterpriser, a successor might see deregulation differently. The Labour party is committed to the remonopolisation of British Telecom if it gets back into office.

The first stage of the liberalisation,

permitting attachments—and Britain's is now one of the most liberal attachment policies in Europe—cannot be undone. But, as was explained earlier, the juiciest part of the new market, PABXs, will not be opened to wider competition for three years—and that is beyond the life of the present government. That protectionist period could of course be extended—or eliminated.

Even on attachments, the arrangements being proposed for settling standards for connection to British Telecom are so cumbersome—and dependent on BT's own approval—that it will have considerable scope for discouraging anything too innovative. A two-stage procedure is being set up, which requires applicants to pass first the British Standards Institute and then the British Electrical Approvals Board. At best, competition will be slow to get going—but in the interim BT will be hard-selling its own "intelligent" telephones and other wares.

BT will also have tough powers to punish those who use non-approved equipment. They may be disconnected, or, if they are sellers, fined £20,000 or given two years in prison, or both. Some retailers argue, however, that the British network is more in danger from cheap faulty equipment from the Far East flooding the market than the United States ever was. (The new penalties for non-approved equipment may even stimulate the sudden dumping at cut prices of all kinds of gadgets which the sellers, but not the customers, realise will soon become illegal.)

British Telecom does have one enormous legitimate grievance: the refusal of the treasury to let it finance its £2 billion-a-year modernisation programme by private borrowing. The treasury insists that any such bonds sold to the public must be considered as public expenditure, as the government is the ultimate guarantor. The treasury's attitude drove the last chairman, Sir William Barlow, back to private industry in a rage. His successor, Sir George Jefferson, formerly of British Aerospace, has a thicker skin, so far. Patiently making the rounds, he intones "if we are to compete commercially, we must be able to borrow commercially". So far his plea has fallen on deaf ears.

As good as anybody else

One of the troubles of the past was that the old British Post Office was engineer-led. It was concerned with the highest standards of reliability—telephones that would last 20 years—rather than making an appeal to the consumer. As a result, the regular suppliers to the Post Office grew torpid.

Today there are new entrepreneurs with electronic products who are so excited by the liberalisation of the British market that they can hardly sleep at night. The more established suppliers are worried. One fears that liberalisation has come a decade too late to catch up with international technology.

"We haven't had a market to meet", said he. "It's astonishing it wasn't seen by the politicians 10 years ago. Now we welcome competition. With safeguards, of course [like the three years' protection]. We need time to adapt and redesign. Then to have the markets open to us on an equal basis."

And then? "We have to be as good as anybody else or we will die."

Who's skimming the cream?

Sir Keith and the department of industry were determined not to stop at liberalising just attachments. They wanted to have a full-scale SBS-style competitor to set up against British Telecom. To their dismay, few well-heeled companies were keen to try their hand, for anybody with a toe in telecommunications knew the massive outlay of capital required.

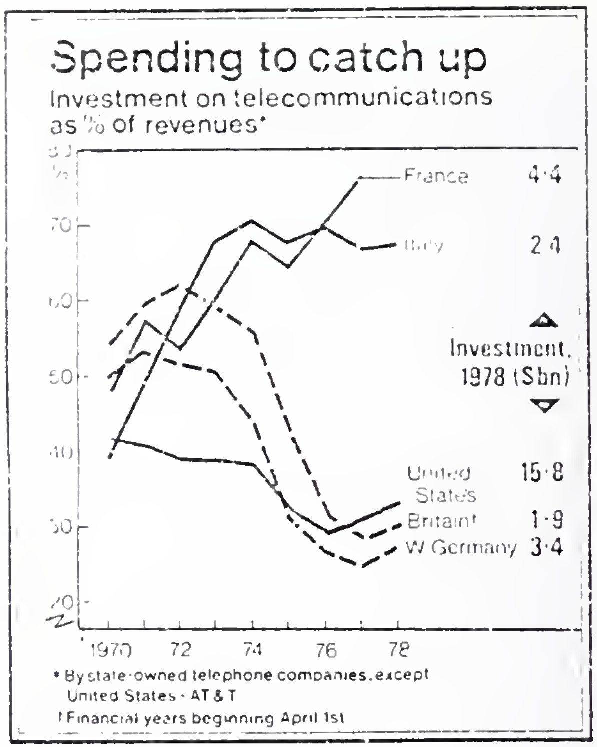
To rock the establishment, use the establishment. Setting up in competition with British Telecom is as revolutionary as setting up commercial television against the BBC was in the early 1950s. The industry department has gratefully received the application of a consortium it encouraged to form, Barclay's Merchant Bank, British Petroleum and Cable and Wireless, to set up an independent trunk broadband network, based on optical fibres laid along the tracks of British Rail. So far the department has given the go-ahead in principle, but the specific licence should not be far behind. The consortium calls its proposed service Mercury. It sees itself as offering something entirely new—priority point-to-point communications for the business customer, 64 kilobits-per-second data carrier and no 18-months wait for service. It will combine the fibre transmission with short-range microwave within cities and, for that last important stage of the journey, into the building, cellular radio.

British Telecom's response has been in the best tradition of monopoly. It says: a competitive network would force British Telecom's rates up—especially on telephone box calls and in rural areas by skimming off the cream created by the profitable trunk services.

Skimming the cream? The suggestion makes Mr Eric Sharp, chairman of Cable and Wireless, explode. "BT itself is the country's biggest cream skimmer—they've split the profitable service away from the old Post Office and left it with the expensive social service of delivering letters. If they're so worried about rural service, let them provide a subsidy out of their profits to help the rural postal services." All the debate about the costs of competition, he says, does not mention the real cost of monopoly: the inadequate service to the business community. It is British Telecom, he claims, which has failed the customer.

Cable and Wireless, the biggest international operator of telecommunications systems and circuits and lead member of the Mercury consortium, was until this year entirely owned by the British government. Now it is being privatised with about £150m-worth of its shares being offered to the public. The government will retain just over 50%. Whether Cable and Wireless can use its international knowhow in the domestic market is a key question. It is a staid company, press-shy, and slightly hurt to find that, so famous abroad, it is not a household word in Britain. It has a lot to learn about marketing and public relations if it expects to get back the £50m the consortium will invest in the Mercury network. If cream it be, the consortium does not want much: only about as much as 1% of British Telecom's annual revenues, but that would be new money coming from demand at present unsatisfied. It acknowledges that British Telecom will offer a comparable network by 1992 but says "Britain can't wait that long."

If Mercury really gets under way, it will find that British Telecom still holds the trump card: international connections. Mercury is unlikely to get a licence for international communications (even Professor Beesley thought BT should not face such international competition for a while). And if it did, the European posts, telephone and telegraph authorities (the PTTs) will not play ball. When they link up—say for satellite business communications, through the Eurosat satellite to be launched soon—they will want to find at the British end not some commercial upstart, but their old colleague, whom they still think of as the British Post Office.


Spending to catch up
Investment on telecommunications as % of revenues*

* By state-owned telephone companies, except United States - AT & T
† Financial years beginning April 1st

Sources ITU company reports

Can 30m French terminals be wrong?

In 1975 the French embarked on a daring—some say grandiose—crash programme to turn one of the worst telephone systems in Europe into one of the most modern—without relaxing the PTT monopoly at all. (The Italians have still another way: the PTT monopoly skims its own cream—the trunk network is in a separate organisation that keeps its profits and leaves the local telephone organisation starved for money. The Italian telephone service shows it.)

The French have been pouring capital into their telephone system, at a greater rate than Britain is, and taking it from the private market. In 1970 the French PTT was financing 100% of its capital requirements from its own resources but in 1977 only 43% came from its own money. The result was that the number of telephones per head was raised from 7m to 16m in five years; a public specialised data network, Transpac, which is better than the American one, was established; France's telecommunications industry (whose salesmen now speak English with American accents) was rejuvenated; easy coin-box international dialling from street-corners came into being and 55% of French homes are now equipped with telephone sockets; while installing a telephone now is as easy as a new lamp.

Although the French did buy L. M. Ericsson equipment to help out the crash programme, they do not like non-French equipment to be attached to the network. They are moving into optical fibres for local loops—and they will put up a satellite system, Telecom 1, for national telecommunications in 1983.

The French actually benefited from having such a poor network to start with.

Instead of having painfully to renovate a large existing plant, as Britain must do, their PTT has been able to buy new digital equipment, which works beautifully and therefore stimulates use of the network. Already the French expansion has begun to taper off, although growth will continue, and the PTT has been looking for a way simultaneously to preserve jobs in the French telecommunications industry and to develop new sources of revenue for the 1990s.

Its answer: to give away a video terminal to every telephone subscriber, so that by 1990 the whole directory inquiry system can be handled electronically. A contract for 300,000 terminals has been placed with Alcatel Electronique. The first trial scheme is under way in 1,500 homes in Ille et Vilaine, Brittany. Next year the French PTT plans to distribute 270,000 terminals and hopes to have 30m in use by 1990.

The British view of these goings-on is one of extreme scepticism. Let's wait, they say, and see if the project ever expands beyond the experimental stage—and, anyway, what a waste of money it all is: how many minutes a week do people spend looking for telephone numbers? But the French PTT insists that it means business and that its plan will provide a home terminal penetration higher than America's by the 1990s, by which time the terminal and keyboard for electronic shopping and banking will be in the hands of most Frenchmen.

If the new Mitterrand government does not slow down the programme, that is. It too is sceptical of its own PTT's plan to impose new technology upon the public. The video directory project, along with an allied experiment in Télétel, France's Prestel, seems a left-over from the Giscardian wish to "informationise" the French regardless of cost. The Mitterrand policy recently announced is that the electronic directories will not be imposed but offered to the public and that their extension to the whole country will not be undertaken without a debate in the French assembly. Thus even in a country which has never dreamed of taking its telecommunications out of government hands, complaints are now heard that the PTT has become a state within a state.

Unbrotherly love in the EEC

There is practically no cross-border trade in telecommunications equipment in the EEC. The European PTT monopolies, each with their own favourite design of equipment, tariffs and suppliers, have prevented the growth of the transcontinental services and low costs of North American communications. They have also—EEC officials believe—caused Europe to lag behind the United States and Japan in the blending of telecommunications and data-processing.

The EEC commissioner for industry, Viscount Etienne Davignon, has asked member countries partially to relax their monopolies in telecommunications contracts and to aim for 10% reciprocity by 1986. America and Japan have just concluded an agreement to admit some American equipment to the Japanese telephone system. Why not Europe? The European view is: "he'll be lucky".

The European PTTs are not going to play the deregulation game: they are still government departments, run by bureaucrats, who have three other EEC recommendations to consider—that they should standardise new digital network equipment by 1985; that any PTT should accept any other PTT's certificate of approval; and that all applications should be processed within six months.

If the EEC countries do edge into liberalisation, it will be in business equipment and telephone attachments first. Public exchange equipment will take a long time to lose its national colouring.

The danger to Britain if the EEC monopolies do not relax their procurement policies is obvious: Britain's door could be open to continental products—some very, very good—and theirs will be closed to Britain. When, within three years, the protection period runs out, it will be interesting to see whether the department of industry can really keep EEC equipment out if there have not been reciprocal agreements. Protection could then return to British industry, thinly disguised.

Waiting for a line

The telephone is remarkably undervalued as an instrument for development. A country's telephone density tells almost as much about a country's economic performance as does its rate of growth. Korea, Brazil, Mexico and Ireland are in the fast-expanding league.

Those who suffer most from lack of telephones are not the people in mud huts but those in the developing world's cities. They can wait hours for a dial tone and days for an inter-city call. Rush hour on the roads coincides with rush hour on the line, creating comparable chaos. The struggle merely to get a telephone involves bribery and privilege. There can be more people on the waiting list than in the telephone directory.

Telecommunications as a sector for investment has had a low priority, both within poorer countries themselves and among international organisations. Unesco, for all its statements about the need for a more balanced flow of communications between richer and poorer, never mentions telephones. The World Bank, which sees itself as a lender of last resort, has directed only 3% of its loans over 20 years into telephones. It knows it has underinvested but gives the following reasons:

○ The telephone has seemed a luxury, benefiting the richer portion of the population of a developing country.

○ There is little evidence about the economic benefits of better telecommunications.

○ There are other sources of money—notably the multinational manufacturers—for telecommunications projects.

None the less, the bank is the principal multilateral source of finance for telecommunications in the third world and last year, along with its affiliate the International Development Association, provided $1.9 billion for telecommunications to 37 countries. India has been a big recipient over the years.

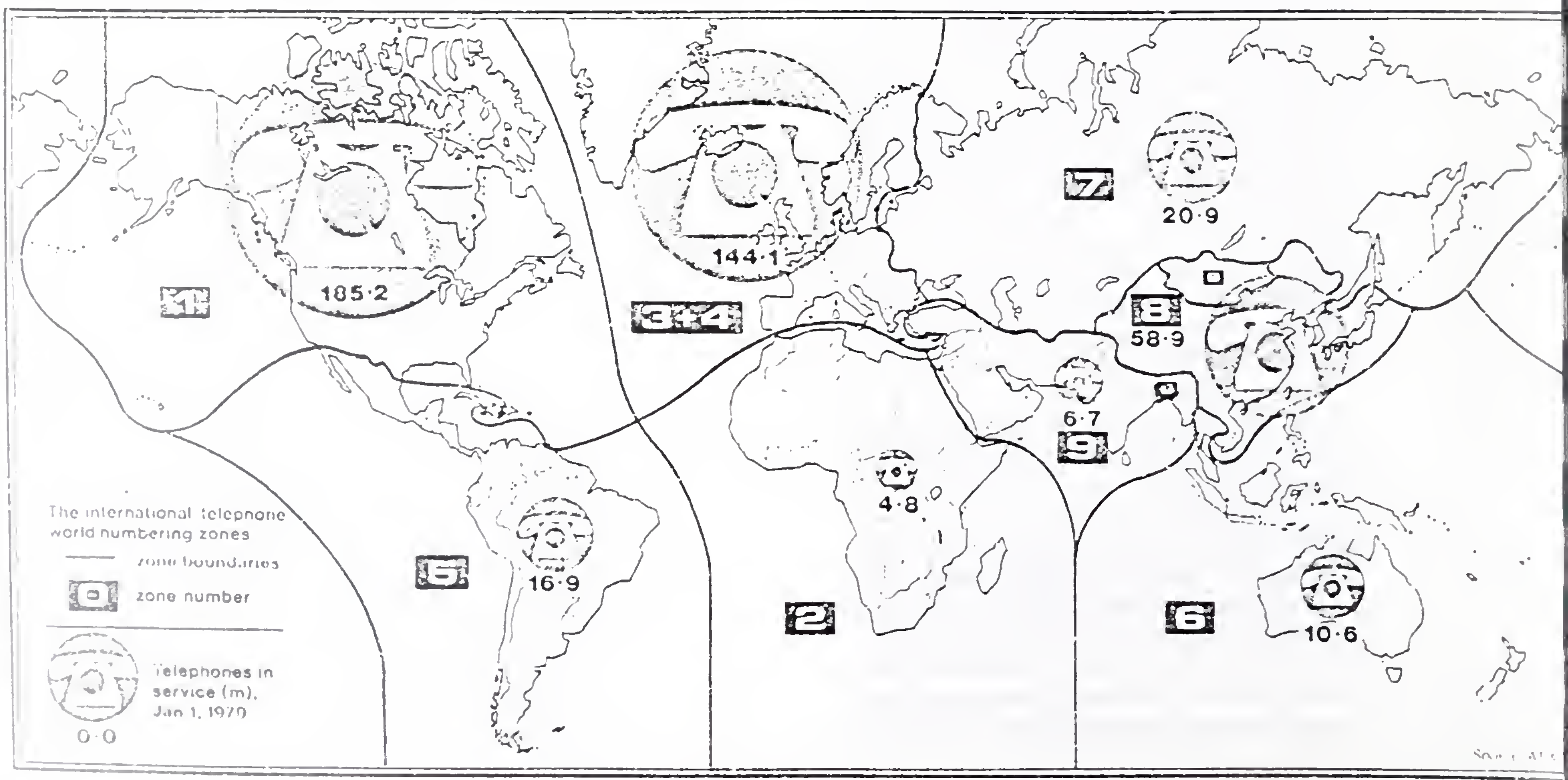
Another international organisation which might help is Intelsat. Since its formation in 1964, this operator of the global satellite system has grown to become the very model of international co-operation and has brought international telephony, telex and television into well over 100 countries. It should now be using its influence with its members to get them to lower the rates for developing countries, too many of which cannot afford to bring down the television programmes, such as the news round-up which the European Broadcasting Union sends up to the satellite free every day.

Unesco recently has set up an International Programme for the Development of Communications (IPDC) to try to work on practical tasks of improving facilities in the third world. At its first meeting in Paris recently, the IPDC got off to a rough start, with the usual first-versus-third world wrangling. Then Mr Arthur Clarke got up—as science writer, inventor of the communications satellite and delegate from Sri Lanka where he now lives. He gave them his vision of the next century: solar-powered radios that need no batteries, hand-held teaching machines, giant satellites beaming signals into wrist-watch telephones.

The appropriate technology for the developing world, he said, is electronic digital technology. It brings forms of communication that are cheap and ideally suited for people who cannot read. It gives the third world a chance to leapfrog into the space age, without investing in the expensive copper-wire networks that slow down the industrialised world's telecommunications advance. And the first priority, he said, should be to get a telephone into every village: "so that anyone can get a message to anyone else within a few hours, with all the implications this has for business and social life".

Mr Clarke's vision pacified the meeting. It was everybody's future he was talking about. The new technology promises to be as equalising as transistor radios or blue jeans and to turn the world—the phrase is his—into "one big gossiping family".

Telephones: the rich and the poor


1
185·2
3+4
144·1
7
20·9
8
58·9
9
6·7
2
4·8
5
16·9
6
10·6
The international telephone world numbering zones
zone boundaries
0
zone number
Telephones in service (m), Jan 1, 1979
0·0

XXIX

Science Council of Canada, Planning Now for An Information Society: Tomorrow is Too Late (1982)

In the course of social and political history, an interval characterized by rapid change or upheaval is referred to as a revolution. This is usually preceded by a period of intellectual ferment and striving for a "better way." Afterwards, a new order prevails: the younger generation is culturally different from the old and society struggles to accommodate itself to new realities.

Industrial evolution seems governed by the same laws. Today, technological developments are occurring at lightning speed. Indeed current advances in microelectronics are causing a worldwide technological revolution which all societies must accommodate. This revolution may cause fundamental changes in human thought and action.

At each stage, inventive reordering of the natural world must be integrated into social, cultural and economic life. This takes time, for human societies do not internalize change easily. In the past, the span of generations was available and usually sufficient. Today we do not have that luxury. Change itself is the new imperative. J. Robert Oppenheimer, father of the atomic bomb, once remarked:

> "One thing that is new is the prevalence of newness, the changing scale and scope of change itself, so that the world alters as we walk in it, so that the years of a man's life measure not some small growth or rearrangement or modification of what he learned in childhood, but a great upheaval."

The New Technologies*

Microelectronics and related developments in communications, computers, education, entertainment, and design and manufacturing have already made an impact on our society, but we are only beginning to understand how far-reaching that impact will be.

Microelectronics, as distinct from the traditional forms of other known technologies, is characterized by two changes of such magnitude that they have brought about, in effect, the creation of a new kind of technology. These changes are:

- enormous reductions in size; and
- enormous reductions in cost.

This transformation has brought with it additional, less dramatic, but nevertheless important, benefits:

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*Many reports have been written in recent years on the new developments in this field. Some authors sought to illuminate one aspect of the "new technologies." Others have tried to place these developments in a future-historical context and to give us a new perspective from which to view the world. In this report, we will avoid detailed discussions of the engineering and theory underlying these developments, and will simply refer to the "new technologies."

- increased speed;
- increased reliability;
- improved energy efficiency; and
- portability.

In turn, these benefits have made possible rapid dissemination of the new forms of computing power and control systems throughout a vast range of products, processes and systems. The microelectronic devices are not only being applied on a massive scale to more products and processes, but are enabling the invention of new goods and services. In addition, they are stimulating expansion and a new sophistication in our communications industries.

The new technologies, based on the integrated microelectronic circuit, comprise such great quantitative changes that another kind of revolution is taking place; not merely a technological one, but a quantum leap in human capabilities. How has this come about? In Report 21, *Strategies of Development for the Canadian Computer Industry* (September 1973), the Science Council, referring to computer and related technologies, stated: "We confront a *transformative technology*, a technology which gives impetus to fundamental change in human thought and action."[1]

The concept is entirely appropriate. From time to time throughout history, a technology comes along that alters forever people's conception of their world. Just as the steam engine was the culmination of a Renaissance dream of a power economy, so in our own day the airplane for example has transformed transportation, annihilating distance.

What was once impossible or extraordinarily difficult and dangerous, involving journeys lasting sometimes years, is now possible, easy and safe; so that an individual might travel from one continent to another on no more than a few hours notice. The management of international crises by shuttle diplomacy is a matter of routine. And costly or perishable goods are daily cargo. Even the name "space shuttle" is a tribute to the conquest of distance and, indeed, of space itself.

Powered flight, together with increases in range, speed and load-carrying capacity, has brought about fundamental changes in human perceptions, attitudes and patterns of life. Yet these changes took place over the span of three generations. The new technologies have made their impact in one.

The Information Economy

The modern industrial state is a complex held together by information. Indeed, we live in what has come to be known as an "information economy."

The structure of a nation's work force is a useful index of the society's evolution from agricultural to industrial to postindustrial. During the past century, for example, the percentage of the work force in the United States engaged in agriculture has declined from about 50 per cent to 4 per cent. Agricultural production became more efficient as an increasingly educated farm population applied mechanization, fertilizers and new crop strains. More and more workers left the farm for other industries and professions; many now work in information-related areas. In Canada, there have been similar patterns of development. For example, from 1931 to 1971, the proportion of Canadian workers in information-related occupations rose from 21 per cent to 40 per cent, and the transition continues at a rapid rate.

The production, processing and distribution of information goods and services is made possible today by a great many developments in computer and related technologies. Our information-dominated society is built upon a foundation of microelectronic chips and an increasingly sophisticated understanding of their use. Related developments in this area include digital transmission of data, increased use of fibre optics and satellites, and improvements in electronic switching and memory.

In the face of continuous, rapid development, it is impossible to predict a final outcome or even to speculate with any degree of confidence beyond the immediate future. Nevertheless, certain changes and trends deserve immediate attention. How and in what ways are the new technologies transforming the lives of Canadians?

The Human Dimension

As consumers, we can afford and use devices that only a few years ago were the preserve of large corporations, institutions and governments. These include electronic calculators, quartz-controlled timepieces, microcomputers, and communications appliances that can be interconnected to the telecommunications network.

Less visible microprocessors are part of our home appliances – stoves, refrigerators, dryers, microwave ovens – and our automobiles, cameras and toys. Entertainment systems, many of which simply did not exist until recently, incorporate the most advanced technology: consider the CB radio, recorded-music systems, cable television with remote control of 100 channels, video games and laser-disc players.

The application of solid state technology can be thanked for a dramatic drop in the unit price of some goods, such as wristwatches. In other cases, such as entertainment systems, improved models have defied inflation and international currency fluctuations, maintaining more or less stable price levels for a decade. Some products are so revolutionary that we have nothing with which to compare them. People also have access to dramatically improved services, such as telecommunications, airline reservation and banking facilities.

On an institutional level, record keeping, high-speed transmission of data and increasingly sophisticated methods of input, data manipulation and output have made possible economies of scale and increasingly flexible and sophisticated services. This is seen in such areas as health insurance, motor vehicle registration, and filing and audit of income tax returns, to name a few. Cradle-to-grave social safety nets would not be possible beyond a rudimentary level without the new technologies.

Space flight, video games and electronic newsgathering are other manifestations of the new technologies. But what of the individual? As consumers, parents, citizens, we are affected, some would say overwhelmed, by these developments. One effect is clear. Our expectations increase; we hunger for more.

As workers, we must cope with changing patterns of employment. Whole classes of unskilled occupations are being rendered obsolete. But not only the unskilled are being displaced. Industrial workers in sectors based on an earlier electromechanical technology are losing their jobs as their employers either go out of business or (to survive) adapt to the new technologies, often replacing skilled workers with the semiskilled.

The dedicated integrated circuit has given rise to product simplification over a vast range of product lines. Assembly of modular components does not require workers trained in traditional trades, and often component manufacture is highly automated. Assembly line workers may find the job market inhospitable as the demand shifts to electronics technologists and computer programers.

A National Response

The historic struggle of Canadians to conquer distance and exploit our rich resources has imposed both constraints and extraordinary demands. Agriculture, forestry and mining in this country require exceptional transportation systems. Our industrial and cultural development demands unique solutions to problems of communication.

Today, these sectors face the twin challenges of adapting to a postindustrial economy and competing with a rapidly industrializing Third World. What might the future hold should we fail to respond to the challenges of the new technologies and the new world they bring in their wake? This report seeks to identify those sectors where the impact of new technologies will be greatest. For if Canada wishes to chart its own course in the emerging information society, Canadians must understand and must be able to apply the new technologies.

As Walter Light, president and chief executive officer of Northern Telecom Ltd has said,

> "Canada can continue to buy, beg or borrow the technology it will need from more competitive and aggressive societies or it can create its own. Two technologies, semiconductors and software, dominate, and will continue to dominate the industrial development of the world. Without mastery of, if not leadership in these two technologies, no nation can hope for more than a peripheral existence."[2]

The impact of new technology, however, goes beyond the industrial to the social and cultural spheres. A recent report, *The Computerization of Society: A Report to the President of France* by S. Nora and A. Minc, states that society must both foster and control the development of the new technologies so that they can be made to serve the cause of democracy and human growth.[3]

It is with this spirit of urgency and breadth of concern that the Science Council of Canada is presenting a discussion of the technologies which, in our opinion, will radically transform Canadian and world society.

The Future

The exponential rate of development we have seen in recent years in the field of microelectronics will continue. The full potential for design and manufacture of integrated circuits at the molecular level is far from being exhausted.

But the real challenge will lie in applications. How can we best make use of one million transistor equivalents on a single chip? Or ten million? Software will be a major area of endeavour. At the Science Council's recent workshop on computer-aided learning (CAL), one participant put it this way:

> "If any of the computer [-aided learning] systems – micros, minis, videotex – are going to take off, it will be because of the quality of the instructional materials, not the technology."[4]

The pocket calculator has become the most tangible symbol of the microelectronics revolution, but communications, perhaps, touch us more deeply. With the majority of our population thinly distributed along the US border, Canada has long recognized the importance of exclusively Canadian transportation and communication systems – from a transcontinental railway in 1883 to a trans-Canada radio network in 1927, a trans-Canada telephone network in 1932, a domestic geostationary communications satellite in 1972, and the first nationwide digital data system in 1973. Further developments in satellites, digital networks, and the creation of Telidon indicate that Canada will continue to play a leading role in the use of communications technologies. Indeed, the merging of computers and communications technology has created a new market which will grow by an estimated 15 to 20 per cent per year for at least the next decade.

The new technologies have achieved a diffusion rate that is 7 to 10 times faster than that of any previous technology. The key is declining costs: memory costs are falling by 40 per cent per year, logic 25 per cent, and communications (overall) 11 per cent.

The power of computers has increased 10 000 times in the last 15 years, while the price of each unit of performance has decreased 100 000 times. In 1990, the cost of computer memory will be 1/400th of today's costs. Continuing developments in memory and circuit technology will produce a 1990 pocket calculator with more power than today's most powerful computer, the $7 million Cray-1.

The diffusion rates are impressive. The rate of change is accelerating. Under the spur of aggressive marketing and the widespread acceptance of microcomputer-based systems by small business, it will continue to do so. A pattern of acceptance is already emerging: first, communications; then, record-keeping and word-processing; finally, production and process control. This may be reinforced in intangible ways through exposure to new entertainment systems at home.

Some recent predictions give pause for thought:[5]

1980-85 • Semiconductor chips contain up to 300 000 transistors giving each chip the power of a mainframe computer.

• All automobiles use microelectronic controls to boost engine efficiency.

• Some 10 per cent of homes have computers or terminals with access to remote data bases, mainly through the telephone but also via two-way cable television and satellite communication.

1985-90 • Semiconductor chips hold one million transistors. Each chip has the power of the biggest IBM System 370 computer.

• All autos are equipped with microcomputers to warn when preventive maintenance is needed and automatically diagnose problems.

- One-third of all homes have computers or terminals. In the office, electronic mail rivals paper mail in volume.
- Robots and "smart" machines with microelectronic sensors replace significant numbers of factory workers.
- Microelectronic implants begin controlling sophisticated new artificial organs, such as hearts.
- Most doctors install computer-assisted diagnostic systems in their offices.
- Most banks are interconnected through a computer network.
- Schools turn to extensive use of computer-aided learning.

2000

- Chips contain 10 million transistors. Each chip has more computing power than is installed today at most corporations.
- "Smart" highways for semiautomated driving enter early development.
- Most homes have computers. Data communications volume exceeds voice volume, and video phones enter the home.
- Robots and automated systems produce half of all manufactured goods. Up to one-quarter of factory workers may be dislodged.
- Microelectronic implants restore sight, hearing and speech.
- Computer-assisted medicine extends into the home.

Prediction is hazardous, at best. The shape Canadian life will take in the coming decades is unknown. But it is clear we are in the midst of a profound transition that will have an impact on every facet of modern life. Canadians do not live in isolation from the rest of the world. We must formulate our responses and plan now. We cannot afford to adopt a "wait and see" attitude.

This period of transition is a time of crisis. An unstable time for Canadians as citizens and workers and for our industrial sector. It is a time when the terms "information overload," "invasion of privacy," and "global village" take on new and more personal meaning. We must come to terms with a powerful technology that has already made itself felt in many sectors of Canadian life.

Government could play an important role as an "honest broker" – to monitor developments, to alert relevant government agencies (at all levels) to key issues, to develop comprehensive policies, and to serve as a bridge between the many sectors of society that will be affected.

Educational institutions also have a responsibility for framing responses to the challenges of the microelectronics revolution. The shortage of individuals with skills related to the electronic communications age is a sad reflection on the ability of the educational system to be both a custodian of past knowledge and a leader in the development of the new.

Industry and the business community in general must shoulder part of the burden. Managements that failed to recognize the importance of research, planning, development and industrial strategies have severely handicapped such diverse industries as watchmaking in Switzerland and automobile manufacturing in the US and Canada. Canada's competitive position in the world, the pattern of employment, our very standard of living is a reflection of the degree to which Canadian enterprise faces the challenges of the coming decades.

This report highlights some of the key issues and problems that Canadians must face during the transition to the information society.

Week I Overview of Canadian Telecommunications Industry

[A] Introduction:

Canadian Telecommunications: An Overview of the Canadian Telecommunications Carriage Industry, DOC Fact Sheet, 1986.......................... I-1

H.N. Janisch, "Telecommunications Ownership and Regulation: Compatibility or Confusion?" (1984) 5 C.R.R. 5-23......................... I- 12

[B] Two Current Organizational Issues

(i) The Bell Canada Reorganization

H.N. Janisch, Bell Canada's Reorganization: Private Interests and Public Concerns," (1982) 3 C.R.R. 5-43................................. I- 22

Report of the CRTC on the Proposed Reorganization of Bell Canada, 1983.......................... I- 27

Bill C-13, First Reading Oct. 24, 1986............ I- 33

Newspaper Comment - BCE, Bruncor etc and the Baby Bells................................. I- 39

(ii) Privatization of Teleglobe

Hudson Janisch & Richard Schultz, "Teleglobe Canada: Cash Cow or White Elephant?" Stanbury & Kierans (eds), Paper on Privatization, Montreal, IRPP, 1985.......................... I- 52

Government Policy Statement, "Divestiture of Teleglobe Canada, Conditions and Process of Sale", Nov. 19, 1986....................... I- 100

Newspaper Comment................................. I- 110

Week II Overview of Regulation of Canadian Telecommunications Industry

[A] Federal Regulation

CRTC Act.................................... II- 1

National Transportation Act.................. II- 4

Railway Act................................. II- 6

CRTC Annual Report.......................... II- 9

Charles Dalfen, "Telecommunications and Regulation"................................ II- 16

Leonard Waverman, "The Process of Telecommunications Regulation in Canada"... II- 23

[B] Provincial Regulation

CAMPUT "Rate Making/Rate Design"............ II- 27

[C] Jurisdictional Issues

H.N. Janisch, "Federal Provincial Relations in Canadian Telecommunications"........... II- 35

Re Alberta Government Telephones............ II- 78

[D] Towards a Political Solution?

DOC Press Release, Feb 28, 1986.............. II- 100

A Leaked Document, Oct. 1986................. II- 102

Week III: The Rationale for Regulation and Traditional Regulatory Issues

A. The Rationale for Regulation

CNCP Telecommunications, Crisis in Canadian Telecommunications Policy and Regulation, Toronto, May 1982, p.3 III - 1

Economic Council of Canada, Reforming Regulation, Ottawa, 1981, p.37 III - 2

Carl E. Beigie, Submission of CNCP Telecommunications to the Telecommunications Inquiry into the Provision of Local Non-Broadcasting Telecommunication Services in Alberta, 1978, pp.2-6 III - 3

A. Lapointe, Telecommunications and Government (Canadian Telecommunications Carriers Assoc., 6th Annual Meeting, pp.19-20) III - 7

Alfred E. Kahn, "Introduction: The Rationale of Regulation and the Proper Role of Economics", from A.E. Kahn, The Economics of Regulation, Volume 1, New York, 1970, pp.2-18 III - 9

Gerald W. Brock, The Telecommunications Industry, Harvard University Press, Cambridge, 1981, pp.9-16 III - 15

B. Rate Base and Rate of Return

Alfred E. Kahn, "The Traditional Issues in the Pricing of Public Utility Services", from A.E. Kahn, The Economics of Regulation Volume 1, New York, 1970, pp.20-57 III - 20

P.J. Garfield and W.F. Lovejoy, "The Rate Base" from Garfield and Lovejoy, Public Utility Economics, Englewood Cliffs, N.J., 1964, pp.56-65 III - 42

P.J. Garfield and W.F. Lovejoy, "Rate of Return" from Garfield and Lovejoy, Public Utility Economics, Englewood Cliffs, N.J., 1964, pp.114-124 III - 51

A.J. de Grandpre, Fair Return for Utilities - Concept or Reality?, 16 McGill L.J. 19 (1970) III - 60

Introductory Note

The issues presented in this week's materials are not the "sexy" ones. On the surface, discussions about the rate base or the appropriate rate of return are dry and tedious, lacking the capacity to excite. However, it is crucially important to be familiar with these topics. The issues presented here represent the signals to which the telephone companies have responded for seventy years. An understanding of these traditional signals is basic to an understanding of the present methods of operation of those companies. Further, questions about for example the influence of the rate of return or the effect on quality of service will appear with surprising regularity as we discuss more "current" concerns.

Students should bear in mind that the treatment of these issues is decidely brief and artificially isolated. No attempt is made to provide any comprehensive overview of the topics, and for the sake of exposition, the topics are dealt with individually although, in practice, they are closely inter-related.

"I'm sorry, I never see anyone personally. However, you may call me from that phone."

Week IV - The Pricing of Telecommunications Services

A. Pricing Principles

Charles River Associates, *The Economics of Competition in the Telecommunications Industry*, Cambridge, Mass., 1980, pp.75-93; 101-103 IV - 1

Canadian Association of Members of Public Utility Tribunals (CAMPUT), "Rate Making/Rate Design", 1 *C.R.R.* E-1 (1980, pp.E-9 - E-13 IV - 18

Posner, Richard, *Taxation by Regulation* IV - 23

B. System-Wide Pricing

Intervention on behalf of the Consumers' Association of Canada and H.N. Janisch, *In the Matter of an Application of Maritime Telegraph and Telephone Company Limited*, May 28, 1974 IV - 31

F.M. Waller, *Statement on Rate Philosophy*, Exhibit c/28 1974 Rate Application by MT&T IV - 41

F.M. Waller, *Why System-Wide Pricing?*, Exhibit c/29, 1974 Rate Application by MT&T IV - 48

W.S. Robertson cross-examined by H.N. Janisch, 1974 Rate Application by MT&T, Transcript IV - 53

C. Flat v. Measured Service

Janisch, H.N. (ed.), *Telecommunications Regulation at the Crossroads*, Proceedings of a Conference at the Faculty of Law, Dalhousie University, Halifax: Dalhousie Continuing Education Series, 1976, pp.129-149 IV - 64

Withers, W.J., "Developments in Usage Sensitive Pricing for Local Exchange Service", 2 *C.R.R.* 5-1 (1981), pp.5-3 - 5-6 IV - 79

Introductory Note

> I looked in the phone book and saw that the cost of calling between Halifax and Vancouver between midnight and 8 a.m. is 30 cents a minute. Now I question whether it's really worth charging anybody for that. Can you figure out a way to charge somebody for anything today which is going to cost you less than 30 cents to charge them? And if not, what exactly if the point of charging them for it?
>
> Nicholas Johnson

> "The process of developing and proposing revised rates is primarily a judgmental process."
>
> Bell Canada, Increase in Rates
> Telecom Decision CRTC 77-7,
> 1 June 1977

The materials for this week explore the pricing of individual telecommunications services. They begin by examining the identifiable goals of regulatory rate making. Next, system wide pricing, the method used for over half a century, is explored. The third section highlights the differences between flat rate and the usage sensitive approaches to pricing.

The first three sections examine pricing from a "global" point of view. The fourth section takes a closer look at the cost of individual services. What should be the differential for example, between business and residential rates?

Note that by "judiciously" setting the price of particular telecommunications services, the telephone company can artificially stimulate the demand for that service. Any market mechanism that might correct this distortion in the allocation of resources is undercut by the guaranteed rate of return accorded the telephone company.

How then can subscribers indicate their preferences, e.g. how can a customer indicate the extent to which he wants the utility to continue improving service? Is it necessary to remove the telephone? Can the customer truly be said to determine the level of service?

In reading these materials, students should decide, at a theoretical level at least, to what extent the pricing of telecommunications products and services should be cost based. How could this be achieved?

Week V: The Technology of Telecommunications

A. Introduction

Restrictive Trade Practices Commission, *Telecommunications in Canada: Phase I - Interconnection*, Ottawa: Supply and Services, 1981, pp.23-26 — V - 1

Martin, *Future Developments in Telecommunications* (2nd ed.), Englewood Cliffs, N.J., 1977, p.31 — V - 4

B. Terminal Equipment: The Telephone

Bell Canada, *Telecommunications...the telephone plus*, Toronto, 1977, pp.4-8 — V - 4

McGraw Hill Encyclopedia of Science and Technology, (5th ed.) New York, 1982, Volume 13, pp.512-513 — V - 8

C. Transmission Links

Martin, *Future Developments in Telecommunications* (2nd ed.), Englewood Cliffs, N.J., 1977, p.134 — V - 10

World Book Encyclopedia, Chicago, 1979, Volume 19, p.81 — V - 11

McGraw Hill Encyclopedia of Science and Technology, (5th ed.), New York, 1982, Volume 13, pp.518-520 — V - 12

D. Switching

Bell Canada, *Telecommunications...the telephone plus*, Toronto, 1977, pp.10-11 — V - 15

World Book Encyclopedia, Chicago, 1979, Volume 19, pp.81-83 — V - 16

McGraw Hill Encyclopedia of Science and Technology, (5th ed.), New York, 1982, Volume 13, pp.419-22 — V - 17

Encyclopaedia Britannica Macropaedia, Chicago, 1979, Volume 18, pp.92-4 — V - 20

E. Analog versus Digital Transmission

Martin, *Future Developments in Telecommunications* (2nd ed.) Englewood Cliffs, N.J., 1977, pp.45-48 — V - 22

F. Terminal Equipment: Mobile Telephones and Private Branch Exchanges

Re Bell Canada and Challenge Communications Ltd. (1978) 86 D.L.R. (3d) 351 (F.C.A.) pp.353-4 V - 31

Martin, *Future Developments in Telecommunications* (2nd ed.), Englewood Cliffs, N.J., 1977, pp.187-192 V - 32

Martin, *Future Developments in Telecommunications* (2nd ed.) Englewood Cliffs, N.J., 1977, pp.71-75 V - 35

McGraw Hill Encyclopedia of Science and Technology (5th ed.) New York, 1982, Volume 13, pp.517-518 V - 38

Introductory Note

Some grasp of the technology of telecommunications is essential to an understanding of regulation in this area. Quite obviously, past limits of the then-existing technology determined the physical structure of the network and hence defined the signals to which the regulators needed to respond. To understand the significance of modern technical developments and to appreciate the implications of current regulatory decisions such as the terminal attachment decision, some understanding and appreciation of present and emerging technology is required.

Future developments promise a cornucopia of new products and services (all of which require an appropriate regulatory response), and raise the possibility of bypassing the local loop. This technological juggernaut threatens to destroy regulation both by overloading the system and by overturning any natural monopoly justification for its existence. A complete appreciation of the challenge this presents to regulators requires a knowledge of the technology involved.

These materials seek to introduce law students to the basic technology from a conceptual rather than a mathematical or physical point of view. After a brief introduction to the components of the telecommunications network, the materials discuss the three physical components, the telephone, the transmission links and the switching equipment in more detail. Next the differences between analog and digital transmission are outlined. These differences are particularly significant for data transmission. Two types of terminal equipment beyond the basic black telephone are then described. The emphasis in this section is on a description of the features of this equipment rather than any technical discussion of its operating principles. Next, the potential of the communication satellite and optical fibres is addressed. These present the possibility of overcoming the limitations of cooper wire. The final section deals with switched data networks. While presently voice transmission accounts for 95% of the workload, within a few years data transmission is expected to grow to the 50% level. As the materials outline, data networks have significantly different requirements than voice networks.

In reading these materials, concentrate on understanding the principles rather than any precise technical explanation. And ask yourself how well a regulatory scheme designed to cope with the stable environment of Plain Old Telecphone Service will cope with the technological revolution.